Magnesium Diboride Superconducting Coils for Adiabatic Demagnetization Refrigerators (ADR's), Phase II

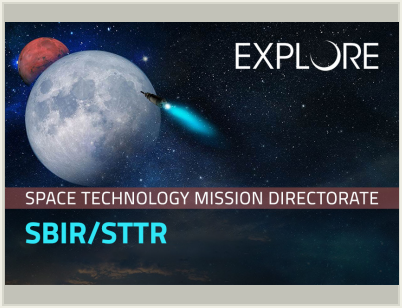
Completed Technology Project (2005 - 2007)

Project Introduction

For Adiabatic Demagnetization Refrigerators (ADRs) in space applications, it is desirable to have very light weight, small diameter, high current density superconducting wires that can operate at temperatures in the 10-30 K range, specifically with engineering current densities in the 50,000-100,000 A/cm2 range, at 15K in 3 tesla fields. Magnesium diboride, a light-weight superconductor wire, is the ideal candidate coil material for ADRs in the 10-30 K range. During the Phase I we demonstrated that drawing magnesium diboride wires to the needed diameter range could be achieved. However to meet the most desired application requirements we need slight improvement in superconductor current density, reduction of powder filament size, and higher percent superconductor fraction at the desired wire diameter range of 0.075 mm - 0.150 mm. In the Phase II effort we propose a development plan to make these improvements to small diameter magnesium diboride wire and to demonstrate conductor performance over long length on small coils.

Anticipated Benefits

Commercialization of magnesium diboride superconducting wires will allow less expensive and more open MRI systems for medical use, and lower cost and more efficient power utility applications such as transformers, motors, generators, fault current limiters, and SMES. Magnesium diboride will also be useful for superconducting Maglev Trains for the transportation industry, and for the High Energy Physics community the magnesium diboride wire will be useful for wiggler and undulator magnets. In addition to ADR coils, magnesium diboride superconductors can benefit NASA applications for superconducting large aircraft motors, transformers, inductors, magnetic bearings, actuators, MHD magnets, and other potential power conditioning applications.



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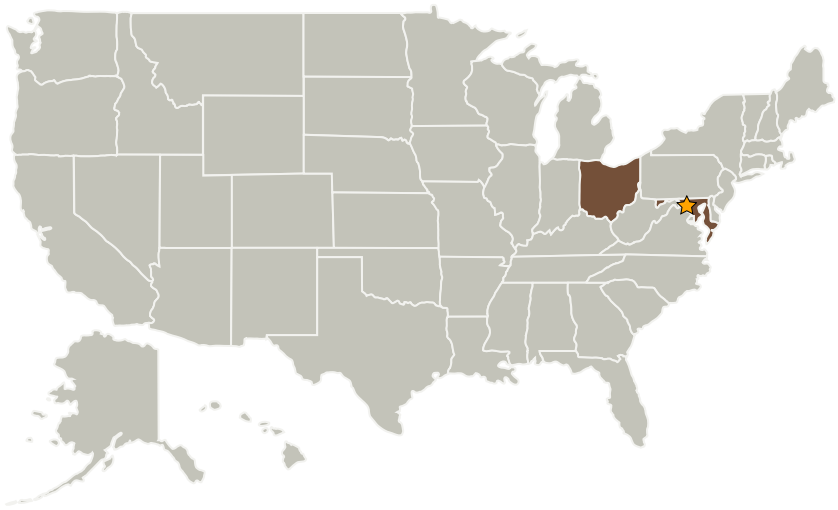
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Hyper Tech Research, Inc.	Supporting Organization	Industry	Columbus, Ohio

Primary U.S. Work Locations	
Maryland	Ohio

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

John S Panek

Principal Investigator:

Matthew Rindfleisch

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials

Continued on following page.

Magnesium Diboride Superconducting Coils for Adiabatic Demagnetization Refrigerators (ADR's), Phase II

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Technology Areas *(cont.)*

- TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines